are issued on separate sheets, so that they may easily be made of immediate and permanent educational value in the laboratories of geography and geology, and each such laboratory in America should make arrangements for at least one complete copy of the atlas before the edition is exhausted.

The general plan of the atlas includes:

1. Forms produced by disintegration and the action of gravity: mechanical and chemical disintegration; rock-waste, landslides, etc.

2. Elementary forms produced by erosion by running water: ravining, erosion in swirls, torrents, etc.

3. Complex forms produced by erosion by running water: gorges, valleys; maturity more or less advanced; successive cycles.

4. Forms affected by the character of the rocks: massive, slaty, incoherent, permeable, and soluble rocks.

5. Forms produced by erosion of rocks of various structures: surface features associated with folding and faulting; epirogenic movements.

6. Forms connected with glacial action: existing glaciers, erosion and deposit; ice age.

7. Forms of desert regions: wind erosion; dunes, etc.; complex desert forms.

8. Coastal forms: simple forms due to erosion and accumulation; changes of shore line.

9. Volcanic land forms: accumulation (cones, lava flows, etc.), forms produced by denudation.

The completed atlas will contain 10 series of 6 parts each. Each series will contain from 45–48 plates, so that the atlas will include 450–80 plates and from 1800 to 1900 pages of descriptions, illustrated with maps and diagrams.

W. W. A.

The Fuels Used in Texas. By WILLIAM B. PHILLIPS and S. H. WORRELL. Bull. of the University of Texas, No. 307. 1913. Pp. 287, pls. 22.

The fuels used in Texas are natural gas, oil, sub-bituminous coal, and lignite. All these fuels are produced in the state. For the year 1912 the production of oil was 12,000,000 barrels, 1,200,000 tons of sub-bituminous coal, and 990,000 tons of lignite.

The sub-bituminous coal is mined in three fields. In the north-central part of the state Carboniferous beds carry coal, and on the Rio Grande in two localities coal is worked in beds that are probably Cretaceous. The coal seams are not more than two feet thick in any place.

The object of the report is to emphasize the fact that lignite properly utilized is a valuable commercial fuel. Lignite is well distributed over the state, but it is especially valuable in the northeastern part. It is included in the Timber Belt, Yegua, and Fayette formations of the Eocene period, in the first of which it is most abundant, and there the individual seams reach a thickness of 15 feet.

The value of lignite is shown by chemical analyses and by results of boiler tests. Exclusive of expense of handling, the cost of evaporating 1,000 pounds of water is, on the average, with coal as fuel, 30 cents per pound of water, with lignite, 20 cents, and with oil, 15 cents. Natural gas is the cheapest fuel, but it is obtainable only locally. Lignite may be used as raw coal, as fuel under stationary boilers, as a fuel in gas-producers, for briquetting raw or dried, and for dry distillation and recovery of by-products. It is actually used mostly as raw fuel under stationary boilers. The authors strongly support the report of Dean Babcock of the University of North Dakota that the chief value of lignite will be obtained from its briquetting. They agree that it is almost hopeless to attempt to make useful briquettes out of raw lignite, but that by carbonization (driving-off of the volatile gases), or partial carbonization of the coal and briquetting of the carbon-high product, a commercial fuel may be made which will be of the same order of efficiency as anthracite.

T. T. Q.

Geology of the Titanium and Apatite Deposits of Virginia. By THOMAS LEONARD WATSON and STEPHEN TABER. Virginia Geol. Sur. Bull. No. III–A. 1913. Pp. 300, pls. 37, figs. 22, map 1.

The titanium and apatite deposits of Virginia are in the northwestern part of the state. Rutile is found both in massive syenite and in nelsonite dikes. The apatite is most abundant in some of the nelsonite dikes. The report discusses the subject of titanium quite fully. The chemistry of titanium, its ores, their distribution, and the uses of titanium products are treated fully. Titanium is used in metallic alloys, such as ferro-titanium, cupro-titanium, etc., for lighting purposes as incandescent media, as mordants, as refractory coloring materials for the ceramic industry, etc.

The rocks in the area are igneous in origin and distinctly metamorphosed. They form a peculiar comagmatic group which is characterized by the abundance of ilmenite, rutile, and apatite. These minerals